Summary of Rejections

In ¶2 of the Office action, claims 1, 4-6, 8-12, 18, 19, and 21-24 have been rejected under 35 USC §102(b) as being anticipated by Pickens '003 (US Patent 5,455,003).

In ¶4 of the Office action, claims 2, 3, 7, 13-15, and 20 have been rejected under 35 USC §103(a) as being obvious in light of Pickens '003.

In ¶5 of the Office action, claims 16 and 17 are rejected under 35 USC§103(a) as being obvious in light of Pickens '003 in view of Rioja et al. (US 5,137,686).

Legal Precedent Regarding Sections 102 and 103

The fundamental premise of anticipation under 35 USC §102 is that the prior art reference discloses each and every element of the claim to which it is applied. *In re King,* 801 F.2d 1324, 1326, 231 USPQ 36, 138 (Fed. Cir. 1986). There must be no differences between the subject matter of the claim and the disclosure of the prior art reference. Stated another way, the reference must contain within its four corners adequate direction to practice the invention as claimed. The corollary of the rule is equally applicable: absence from the applied reference of any claimed element negates anticipation. *Kloster Speedsteel AB v. Crucible Inc.*, 793 F.2d 1565, 1571, 230 USPQ 81, 84 (Fed. Cir. 1986).

At present, Applicants note that the application of these legal standards by the United States Patent Office is similarly described in the Manual of Patent Examination and Procedures (the MPEP). In relevant part, the MPEP provides guidance for the application of these standards for situations where, like here, there are range limitations that partially overlap or touch upon the disclosures of the published art.

In relevant part, when the publication describes a range that touches/overlaps the claimed range, but does not disclose an example within the range, MPEP §2131 states,

> ...[A] case by case determination must be made as to anticipation. In order to anticipate the claims, the claimed subject matter must be disclosed in the reference with "sufficient specificity to constitute an anticipation under the statute." What constitutes a "sufficient specificity" is fact dependent. If the claims are directed to a narrow range, the reference teaches a broad range, and there is evidence of unexpected results within the claimed narrow range, depending on the other facts of the case, it may be reasonable to conclude that the narrow range is not disclosed with "sufficient specificity" to constitute an anticipation of the claims. The unexpected results may also render the claims unobvious. *Emphasis added.*

Similarly, before addressing the above rejections under 35 USC § 103, the Applicants would like to respectfully address legal precedent regarding 35 U.S.C. § 103. First, under §103, each claim at issue should be considered "as a whole" and the prior art likewise should be considered "as a whole", rather than using "selected bits and pieces from prior patents that might be modified to fit its legally incorrect interpretation of each claim as consisting of one word", a test rejected in *Panduit Corp v. Dennison Manufacturing Co.*, 1 USPQ 2d 1593, 1605 (Fed Cir. 1987).

Using this analytical framework, under § 103, a patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 if the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. 35 U.S.C. § 103(a). The language "obvious at the time the invention was made" has been held by the Courts to mean that it is inappropriate for the Examiner to use "hindsight" in determining obviousness. *Panduit Corp. v. Dennison Mfg. Co.*, 774 F.2d 1082 (Fed. Cir.1985).

Nor can it be lawfully asserted that it would have been obvious, at the time of the Applicant's invention, to try varying conditions. "Obvious to try" has been expressly and repeatedly condemned as the standard under §103. *See, In re Geiger*, 2 USPQ2d 1276, 1278 (Fed. Cir. 1987) and the case precedent cited therein, including *In re Goodwin*, 198 USPQ 1, 3 (CCPA 1978) which states:

> At best, the PTO has shown evidence that it would have been obvious to the skilled artisan to try Margrave's carbon monofluorides. However, this court has consistently refused to recognize "obvious to try" rejections. "As we have said many times, obvious to try is not the standard of 35 USC 103. *[Citation omitted]*

With respect to §103, the MPEP states that, to establish a *prima facie* case for obviousness, three basic criteria must be met: 1) a suggestion or motivation to modify the reference or combine the reference teachings; 2) a reasonable expectation of success; and 3) the prior art must teach or suggest all of the elements of the claim. See MPEP §2143.

Finally, should a *prima facie* case of obviousness be established by the office, it may be overcome by sufficient objective evidence of secondary considerations. See MPEP §2141. In situations such as the instant claims, where the claimed ranges overlap or touch upon ranges disclosed in the prior art, a *prima facie* case may be overcome by 1) evidence of unexpected results; 2) an indication within the prior art that teaches away from the claimed range; and 3) evidence of the criticality of the claimed ranges. See MPEP §2144.

Argument

Introduction

Applicants respectfully traverse the rejection of the pending claims in the instant application.

First, Applicants' amendment to the claims traverses the rejection of claims 1, 4-6, 8-12, 18, 19, and 21-24 based on anticipation under 35 USC §102(b) by the Pickens '003 patent. (See Office Action, ¶2). The claims as amended no longer read or touch upon Pickens example "Q", the only specific example in the Pickens disclosure that arguably may have fallen within or touched upon the presently claimed ranges.

Second, Applicants traverse the rejection of the rejection of claims 2, 3, 7, 13-15, and 20 under §103 based on obviousness under 35 USC §103(a). (See Office Action, ¶4). Applicant's respectfully maintains that a *prima facie* case for obviousness has not been met, as the Pickens patent does not teach or suggest each and every element of the invention as presently claimed when Pickens is read as a whole. For example, the limitations of claim 1, wherein the percent weight of Li is from about 0.10 to about 0.80 wt%, the weight percent of Mg is from 0.6 to 2.0 wt%, and the limitation and "wherein the Cu and Mg are present in the alloy in a total amount below a solubility limit of the alloy" are neither disclosed nor suggested by Pickens '003.

Third, when read as a whole, Pickens '003 patent does not suggest or provide a motivation to select or use the present range of elements, nor control the alloying elements to remain below the solubility limit as the invention is presently claimed. For example, Pickens '003 reiterates the well known facts that increasing amounts of Mg and Zn can be beneficial to a heat treatable alloy to increase the maximum attainable strength and toughness regardless of the Cu level and regardless of its effects on fatigue crack growth resistance. At the same time, Pickens depicts in its Fig. 3 that the increase in strength for a given amount of Mg addition tapers off/plateaus at about 0.6 wt.% Mg. In contrast, the present inventors have shown that

Cu and Mg levels must be tightly controlled to remain at point below the solubility limit of the alloy (which may change due to the presence of other elements) in order to improve fatigue crack growth resistance, particularly with Mg at a level of 0.6 wt% or more.

Finally, even if a *prima facie* case for obviousness were established the criticality of the ranges of Cu, Mg and Li are expressly taught in the specification and demonstrated by the test data submitted with the specific examples disclosed therein. These ranges produce an alloy with superior fatigue crack growth resistance and strength on a level necessary for aerospace applications.

Please note, although Applicants maintain that Rioja, et al. similarly fails to disclose or suggest the above-mentioned limitations (as asserted in ¶5 of the Office action), Applicants have withdrawn claims 16 and 17, in favor of new claims 25 and 26. New claims 25 and 26 are directed to alloys having superior fatigue crack growth resistance performance and to damage tolerant aerospace structural components. No new matter is submitted with these claims, and no additional fees are due as the total number of claims remains constant, and the total number of independent claims remains under 3.

I. Applicants Response to Paragraph 2 of the Office Action: Pickens Fails to Disclose the Instant Ranges with Sufficient Specificity to Anticipate the Present Claims

1. Claims 1, 4-6, 8-12, 18, 19, and 21-24 have been rejected as anticipated by the Pickens '003 application, under 35 USC §102(b). Applicants respectfully traverse this rejection.

2. Applicants have amended the claims to narrow the ranges of Li and Mg,, and to more clearly describe that the amounts of Mg and Cu should be controlled to be below the solubility limit. In particular, the ranges of the alloy composition no longer read upon or touch Pickens'003's example "Q", the only specific example in the Pickens disclosure that arguably fell within or touched upon the claimed ranges of Cu, Mg, and Li.

3. As such, an anticipation rejection based on the disclosure of the Pickens'003 patent is unfounded. Nor is the invention as presently claimed suggested in Perkins with sufficient specificity to anticipate the present claims.

4. It would be apparent to one of ordinary skill, reading Pickens'003 examples, that the ranges of Mg Pickens favors is low, preferably lower than 0.6 wt.%. This is significantly lower than the range presently claimed.

5. For example, as seen in Table 2 of the Pickens patent, of the 33 examples given, the majority have wt.% Mg between 0.3 and 0.40 wt.%. Only example Q in this Table was greater (at 0.60) than this range to a significant extent, and as seen in Table 3 of Pickens'003, the reported room temperature and cryogenic-temperature strength for this alloy is mediocre when compared with preferred

examples such as B and G, which both had yield strength and ultimate tensile strengths 10,000 pounds per square (e.g. 10 ksi) more than that reported for Q.

6. In addition, although Pickens later refers to higher Mg being related to better toughness, Pickens primarily teaches that "peak strengths [are] attained at Mg levels of from about 0.3 to about 0.6 percent." Pickens, col 18:51-59. Moreover, in Fig. 3 of Pickens'003, the improvement in fracture toughness for increasing Mg is shown leveling off at about 0.6 wt.% Mg and higher. One of ordinary skill would thus be directed by the Pickens patent to either use its preferred low Mg range, or would greatly exceed this range to achieve improved strength. Thus, Pickens teachings and disclosures are internally contradictory: on the low end, this would be below the presently claimed range of Mg; on the high end, the teachings of Pickens would exceed the solubility limit of the alloy in substantial part and thus not achieve the present invention.

7. The generalized and non-specific, and contradictory nature of the Pickens disclosure is further seen by comparing Pickens Table 1 with Pickens Table 2. In Table 1, Pickens generically and broadly discloses Cu ranges from 2 to 6.5, Li ranges from 0.2 to 2.7, Ag up to 4.0, Mg up to 4.0 and Zn up to 3.0. See Pickens Table 1. In contrast, in Table 2, all but one example of Mg is 0.41 or below, the maximum Ag is 0.41, and the maximum amount of Zn used is 0.75 wt.%. See Pickens Table 2. Similarly, the "Most Pref." ranges in Table 1 have Li at 0.7-1-1

wt.%, centering on an amount above the range of the present claims, and Mg at 0.3-0.6 wt.%, which centers on and is in fact below the presently claimed range.

8. In short, the general teachings of the Pickens's patent broadly cover a wide but untested and unsupported range, with only contradictory teachings regarding the selection within these ranges. In addition, its specific examples and teachings focus on ranges both substantially above (Li) and below (Mg) the presently claimed range. Thus, Applicants respectfully submit that Pickens'003 cannot be interpreted to teach the ranges of the present invention with the degree of specificity that rises to the level of anticipation under §102.

9. Finally, Pickens does not teach nor does it suggest the importance of maintaining the alloying elements below the solubility limit of the aluminum alloy. As is taught in the application in ¶26, "The term "solubility limit" means the maximum amount of alloying additions that can be added to the aluminum alloy while remaining as a solid solution in the alloy at a given temperature. For example, the solubility limit for the combined amounts of Cu and Mg is the point at which the Cu and/or Mg no longer remain as a solid solution in the aluminum at a given temperature and ancillary Li addition." In practical terms, the solubility limit lines are depicted as lines 1 and 2 for given preferred embodiments in Fig. 1 of the specification. The box in Fig. 1 represents the alloy space, i.e. the weight percentages, of Mg and Cu in the present invention. Here, when the amounts of Cu and Mg are to the right of the solubility lines, the solubility limit of the alloy is

exceeded. As has been found by the present inventors, those amounts to the left of the lines represent alloys where ancillary additions of Li will not lead to the formation of lithium containing, equilibrium deleterious precipitates. Specification, ¶37.

10. The understanding of those of ordinary skill in the art for these alloys has been that fracture toughness decreases with increasing strength, and that δ' phase precipitates improve fatigue crack growth resistance (da/dn). Contrary to this understanding, the present inventors found that both strength and fracture toughness could be increased and that the fatigue crack growth resistance could be greatly improved even in the absence of the δ' phase. Specification, ¶¶ 4, 44.

11. Pickens is silent in this regard, neither teaching nor suggesting the criticality of avoiding the formation of the δ' phase precipitates. Nor does Pickens teach or suggest controlling the amounts of Mg, Cu or other alloying elements to prevent the formation of the δ' phase in order to improve fatigue crack growth resistance.

12. Accordingly, Pickens neither teaches nor suggests, for aerospace components, the limitation of independent claim 1 "wherein the Cu and Mg are present in a controlled amount in the alloy such that they are present in a total amount below the solubility limit of the alloy." Nor does Pickens teach or suggest the mechanical property limitation, a da/dN increase of 27% or more as recited in new

independent claim 25. Similarly, Pickens neither teaches nor suggests the damage tolerant aerospace components recited in claim 26.

13. In view of the above amendments and remarks, Applicants respectfully request the withdrawal of the rejection under 35 USC §102(b) found in ¶2 of the Office Action.

II. Response to Paragraph 4 of the Office Action

A. No Prima Facie Case Can be Made from the Pickens '003 Patent as it Does Not Teach or Suggest Every Element of the Claims as Asserted in ¶4 of the Office Action

14. Applicants respectfully request the withdrawal of the rejection found in ¶ 4 of the office action, where claims 2, 3, 7, 13-15 and 20, wherein these claims are rejected as obvious over Pickens'003 under 35 USC §103(a). Office Action, ¶4.

15. For example, the recitation of claim 1, and therefore, the limitations of the above listed depending claims, include recitations that the percent weight of Li is from about 0.10 to about 0.80 wt%, the percent weight of Mg is from 0.6 to 2.0 wt%, and the limitation "and wherein the Cu and Mg are present in the alloy in a total amount below a solubility limit of the alloy" are neither disclosed nor suggested by Pickens '003.

16. First, as noted above, the alloying element ranges of the claims have been amended, and no longer significantly overlap Example Q disclosed by

Pickens. Further, there are no other examples in Pickens of alloys with Cu and Mg at levels below the solubility limits of the alloy, and have ranges of Cu, Mg, and Li within the ranges as presently claimed.

17. Second, Pickens'003 patent does not provide a motivation to modify its disclosure. Instead. Pickens '003 teaches the importance of the amounts of Cu and Li, and the manipulation of process parameters.

18. For example, Pickens'003 patent further teaches that "The desirable trend [of cryogenic toughness] can be attained by controlling the levels of copper and lithium, and by controlling processing parameters such as stretch, aging and recystallization of the alloys." Pickens'003, col. 5, 1-5.

19. Pickens'003 later reemphasizes this point, stating "In accordance with the present invention, the desirable cryogenic fracture toughness trend can be achieved by controlling Cu and Li levels... The desirable trend can be achieved for Cu levels of from about 2.0 to about 6.5% and lithium levels from about 0.2 to about 2.7%." Pickens, col. 17, 27-35.

20. Although Pickens'003 does indicate that Mg up to 1.0% is possible, it emphasizes that with respect to Mg, "peak strengths [are] attained at Mg levels of from about0.3 to about 0.6 percent." Pickens'003, col 18, 51-59. Pickens'003 similarly teaches that although increasing Mg could increase strength/toughness, the results "vary more" at the highest reported Mg, 0.6 wt.%.. Id.

col. 11, ln. 3. Fig. 3 of Pickens also teaches that the improvement related to Mg additions level off, but still increasing.

21. In addition, Pickens teaches that Cu and Li, not Cu and Mg, should be manipulated in order to control the properties of its alloys (strength, fracture resistance) at cryogenic temperatures like -196°C. "The amounts of Cu and Li employed are interdependent. For example for copper levels at the high end of the broad range, e.g., 6.5%R, the level of lithium should be close to about 1.0% to achieve the desirable cryogenic fracture toughness trend at high strength levels. At the lower end of the broad Cu range, e.g., 2.0%, more Li can be present but the highest strengths attainable will conversely be lower..." Pickens '003, col 17, 44-50, emphasis added. Pickens further teach that "the highest strengths are attained with Li levels from about 1.05 to about 1.35%, a peak at 1.2% lithium." Id. col 17, 60-65.

22. As the Examiner has noted, Pickens'003 patent also teaches using up to 1.0wt% of a grain refiner, up to 0.8 wt.% Ag or up to 1.0% Zn. Office Action, ¶2, pg. 3. Thus, when read as a whole, Picken's teaches those of ordinary skill to add additional alloying and grain refining elements.

23. In sum, one of ordinary skill, reading Pickens'003 as a whole, wishing to increase the cryogenic alloys strength/toughness of a cryogenic alloy to a level appropriate for aerospace applications, would be at most be invited to experiment with increases in Cu, Mg, Ag, Zn, and Li levels.

24. Thus, upon following these teachings, it is respectfully pointed out that the solubility limits of the alloy would be exceeded, (e.g. as in Example 5). This in turn would result in lowered fatigue crack growth resistance. In addition, since those of ordinary skill thought δ' phase particles are beneficial to fatigue crack growth resistance, they would not be directed to nor likely to discover that, as the present inventors had constant amplitude improved fatigue crack growth resistance can be attained in the absence of the δ' phase.

25. Thus, one of ordinary skill, following the express teachings of Pickens'003 patent, would not discover the benefits of maintaining the amount of alloying elements as indicated by the inventors. In short, although Pickens might disclose a test sample near the ranges claimed, Pickens does not teach or suggest using the ranges now claimed in claims 1, 2, 3, 7, 13-15 and 20, or to control the levels of Mg, Li and Cu so as to remain below the solubility limit of the alloy and below the solvus boundary for the formation of the δ' phase.

B. The Criticality of the Ranges (Cu, Mg, and Li) particularly for Controlling the level of Mg and Cu, is Demonstrated by the Examples and Data Presented in the Instant Application

26. The present application expressly teaches the criticality of the ranges for Cu, Mg, and Li for producing aerospace appropriate alloys. For example, in Fig. 5, Comparative data is presented for inventive alloys having increasing amounts of Li, with Mg at 0.75 wt.%, to known data for AA2524 heavy gauge

fuselage sheet. The trends depicted there demonstrate that increasing amounts of lithium beyond the presently claimed range, in the presence of Mg and Cu within the claimed ranges, would result in a dramatic decrease in fracture toughness, Kc and Kapp. Note that these parameters are some of the most critical values for aerospace applications and are not necessarily applicable for cryotank applications.

27. The specification expressly teaches this criticality of this relationship, that "Within the controlled copper and magnesium ranges, the range of lithium content may be from about 0.01 to 0.9 weight percent, preferably 0.1 or 0.2 weight percent to about 0.7 or 0.8 weight percent... However, at lithium levels above the present levels, fracture toughness decreases significantly. Furthermore, care should be taken in not adding too much lithium since exceeding the maximum solubility will lead to low fracture toughness and low damage tolerance." Specification, ¶37.

28. The specification further contains additional teachings regarding the criticality of the ranges for each of the other alloying elements.

29. Cu: "Care must be taken, however, to not add too much copper since the corrosion resistance can be reduced. Also, additions beyond the maximum solubility can lead to low fracture toughness and low damage tolerance". Specification, ¶32.

30. Mg: "Care should be taken, however, to not add too much magnesium since magnesium additions beyond maximum solubility will lead to low fracture toughness and low damage tolerance. Specification, ¶33

31. All Others/Solubility Limit: "... the total amount of Cu and Mg added to the alloy is kept below the solubility limits shown in Fig. 1.... The solubility limits may decrease, e.g. from the first to the second solubility limit, as the amount of other alloying additions is increased. For example, additions of Li, Ag and/or Zn may tend to lower the solubility limit of Cu and Mg." Specification, ¶34. "It has been found that the combination of lower copper levels, higher magnesium levels and lower levels of lithium produce an alloy that has increased fracture toughness and strength, superior fatigue crack growth resistance and relatively low density. Fracture toughness and strength are critical properties for aluminum alloys used in aircraft applications. Fatigue crack growth resistance is also a critical property for damage tolerant aircraft parts, such as fuselage sections and lower wing sections. Specification, ¶44.

32. Finally, the criticality of the claimed ranges is further shown by Example 5 (Table 2) of the present application. Specification, ¶46. The example 5 alloy, presented as a negative example in the present application, one outside the claimed range of Li%, but meets the preferred limitations of the Pickens'003 patent. See Pickens'003, Table 1. As can be seen in Table 3 of the instant application, the toughness and % elongation of this alloy are significantly less than those within the

presently claimed ranges. This further shown graphically in the present application in Figures 2-5. In addition, in Fig. 9 of the present application, data is presented which shows the improvement in fatigue crack growth for alloys having lithium in the instant ranges at a T3 temper (alloy C and alloy D) versus an alloy with no lithium (alloy A).

33. Given these express teachings and evidence regarding the criticality of the ranges taught and presently claimed, applicant respectfully submits that any *prima facie* case for obviousness is rebutted.

III. Response to Paragraph 5: Applicant's Withdrawal of Claims 16 and 17 Obviates the Rejection

34. Applicant withdraws claims 16 and 17 without prejudice, specifically preserving the right to this subject matter in future applications.

35. Therefore, the rejection made in ¶5 of the office action is no longer applicable to the present application.

IV. New Claims 25 and 26 Are Also Patentable over Pickens'003

36. The Pickens'003 application is essentially silent on the issue of increasing the damage tolerance and fatigue crack growth resistance of its cryogenic alloys, and the relationship therein to the solubility limits of the alloy.

37. Similarly, Pickens'003 is also silent on the application of the present inventive alloy in aerospace structural parts such as those requiring high damage tolerance and fatigue crack growth resistance.

38. Thus, applicant submits claims 25 and 26 to more clearly delineate the instant invention. Allowance of these new claims is respectfully requested.

All rejections having been traversed above, it is respectfully submitted that the present application is in condition for allowance. If the Examiner would like to suggest changes of a formal nature to place this application in better condition for allowance, a telephone call to Applicants' undersigned attorney would be appreciated.

Respectfully submitted,

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